

Sanctuary Ecologically Significant Area (SESA)

SESA 10: Very Deep Monterey Canyon

Description

SESA 10 includes the deepest section of Monterey Canyon inside MBNMS boundaries and the surrounding soft bottom slope 2 and rise (2,761-3,276 m). Hard substrate is very rare at these depths (only 1% of SESA); it occurs in both slope 2 and rise depths, which adds to the habitat richness (7 habitats) and habitat diversity (index =3.23) of this SESA. Very little research has occurred in this SESA. There are a few records of structure-forming invertebrates from MBARI ROV surveys. The water over this SESA has relatively low primary productivity and there are no known foraging hotspots although leatherback sea turtles have been spotted. This SESA is located within MBNMS, and research activities may require a permit

(http://montereybay.noaa.gov/resourcepro/permit/permits_need.html).

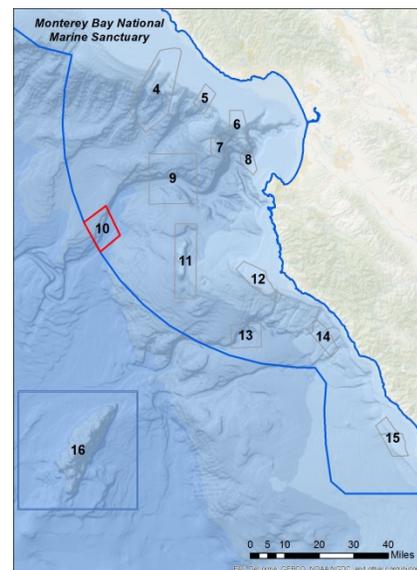


Figure 1. The location of SESA 10 and twelve additional SESAs in Monterey Bay National Marine Sanctuary. Credit: Chad King/MBNMS.

Resource Management Issues

SESA 10 is located in the deepest part of the Monterey submarine canyon within MBNMS. Little biological characterization has been done within this SESA except for some MBARI ROV surveys.

- Adjacent to Essential Fish Habitat (EFH) Conservation Area
- Commercial shipping lane
- Leatherback sea turtle critical habitat

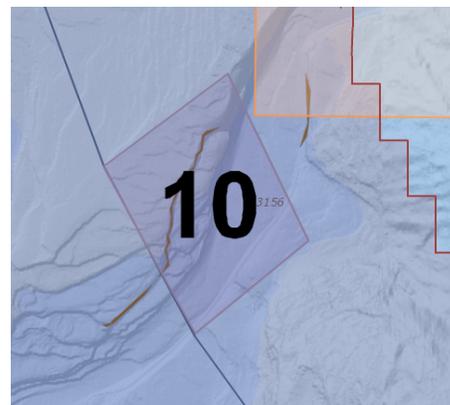


Figure 2. Close-up map of SESA 10. Grey border=SESA boundary; light orange border=EFH Conservation Area; red border=dominant commercial shipping lane. Dark grey border=MBNMS boundary. Source: SESAs Interactive Map, <http://sanctuarymonitoring.org/maps/sesa/>.

Living Marine Resources & Uses

Table 1. Species known to occur within SESA 10: Very Deep Monterey Canyon

Invertebrates	-soft corals† (Alcyonacea) -sea pens† (Pennatulacea) -sea lilies (Crinoidea) -deep sea crabs (Decapoda) (MBARI VARS imagery)
Fishes	Not Sampled
Marine birds	-Northern Fulmar (<i>Fulmarus glacialis</i>) -Leach's Storm-Petrel (<i>Oceanodroma leucorhoa</i>) -California Gull (<i>Larus californicus</i>) -Common Murre (<i>Uria aalge</i>) -Cassin's Auklet ² (<i>Ptychoramphus aleuticus</i>) -Rhinoceros Auklet (<i>Cerorhinea monocerata</i>) (Ainley et al. 2012)
Marine mammals	-humpback whale ¹ (<i>Megaptera novaeangliae</i>) -dolphin (Odontoceti), e.g., Northern right-whale dolphin (<i>Lissodelphis borealis</i>), Pacific white-sided dolphin (<i>Lagenorhynchus obliquidens</i>) -seals (Phocidae), e.g., harbor seal (<i>Phoca vitulina</i>), Northern elephant seal (<i>Mirounga angustirostris</i>) -Northern fur seal (<i>Callorhinus ursinus</i>) (NOAA, 2003)
Marine reptiles	-leatherback sea turtle ¹ (<i>Dermochelys coriacea</i>) (NOAA, 2003)

Special Status Species: Endangered¹; Birds of Conservation Concern²;
Biogenic habitat†

Diverse or productive communities:

- low primary productivity
- low krill production

Migration, breeding, or foraging areas:

- 20% in leatherback sea turtle NMFS critical habitat

Research

SIMoN projects:

CSCAPE: Collaborative Survey of Cetacean Abundance and the Pelagic Ecosystem (2005-07)

<http://sanctuarysimon.org/projects/100273/cscape%3a--collaborative-survey-of-cetacean-abundance-and-the-pelagic-ecosystem>.

MBARI Time Series (MBTS) Program (1992-current)

<http://sanctuarymonitoring.org/projects/100190/mbari-time-series-%28mbts%29-program>

Monitoring whales by Cascadia Research Collective (1991-current)

<http://sanctuarymonitoring.org/projects/100152/monitoring-whales-by-cascadia-research-collective>

Sea Turtle Restoration Project: Leatherback Watch Program (2010-current)

<http://sanctuarymonitoring.org/projects/100395/sea-turtle-restoration-project%3a-leatherback-watch-program->

Structure of Populations, Levels of Abundance and Status of Humpbacks (SPLASH) (2004-current)

<http://sanctuarymonitoring.org/projects/100224/structure-of-populations%2c-levels-of-abundance-and-status-of-humpbacks-%28splash%29>

Tagging of Pacific Predators (TOPP) (2000-current)

<http://sanctuarymonitoring.org/projects/100137/tagging-of-pacific-predators-%28topp%29>

Tracking Black-footed Albatross Movements and Conservation (2004-08)

<http://sanctuariesimon.org/projects/100305/tracking-black-footed-albatross-movements-and-conservation>

Underwater Behavior of Large Whales Using Suction-cup Attached Tags (2000-current)

<http://sanctuarymonitoring.org/projects/100153/underwater-behavior-of-large-whales-using-suction-cup-attached-tags>

usSEABED: A USGS Pacific Coast Offshore Surficial Sediment Data and Mapping Project (2005-current)

<http://sanctuarymonitoring.org/projects/100247/usseabed%3a-a-usgs-pacific-coast-offshore-surficial-sediment-data-and-mapping-project>

Nearby:

Midwater Trawl Pre-recruit Survey (1983-current)

<http://sanctuarymonitoring.org/projects/100118/midwater-trawl-pre-recruit-survey>

Stations and/or data collection instruments: None

MBNMS research:

- CTD profile (NOAA Ship Shimada, 2015)

Science Needs & Research Questions

Habitat Characterization of the Continental Slope

http://sanctuaries.noaa.gov/science/assessment/pdfs/mbnms_characterization_slope.pdf

- What are the distribution and abundance of organisms and habitats on the continental slope?
- How do corals and chemosynthetic communities on the continental slope provide biogenic habitat for other species?
- What is the vulnerability of different continental slope habitats and living marine resources, and are some continental slope habitats able to recover from disturbance at different rates than others?

Human Health - Harmful Algal Blooms

http://sanctuaries.noaa.gov/science/assessment/pdfs/mbnms_habs.pdf

- How do HABs affect local species populations?

Impacts on Whales from Human Uses

http://sanctuaries.noaa.gov/science/assessment/pdfs/mbnms_whale_science.pdf

- What are the spatial and temporal patterns of habitat use of large whales throughout sanctuary waters (both inshore and offshore)?
- What are the environmental and prey characteristics that lead to foraging aggregations that may leave whales vulnerable to disturbance by recreational ocean users?

Socioeconomics and the Human Dimension

http://sanctuaries.noaa.gov/science/assessment/pdfs/mbnms_socioeconomics.pdf

- How do we determine the overall impact of multiple human activities (some with negative and some with positive influence) on Sanctuary resources?

SESAs Interactive Map: <http://sanctuariesimon.org/maps/sesa>

Publically Available Imagery: little to none

- MBARI ROV: Video Annotation and Reference System (<http://www.mbari.org/products/research-software/video-annotation-and-reference-system-vars/>)

SESA Data Layers

Table 2. The 13 SESAs of the MBNMS are comprised of a variety of biological and environmental characteristics that describe unique pelagic and benthic deep sea communities. Listed are a subset of these qualities which include habitat diversity (Shannon-Wiener diversity index); hard substrate area coverage (%); the most common type of habitat; the presence and abundances of corals and sponges, demersal fishes, and marine birds; and the area coverage (%) of upwelling zone within each SESA. Sources: Draft MBNMS report in preparation; SESAs Interactive Map, <http://sanctuarymonitoring.org/maps/sesa/>.

SESA	Habitat diversity (H')	Hard substrate (%)	Primary habitat	Corals & sponges	Demersal fishes	Marine birds	Upwelling zone (%)
4	5.43	8%	Slope 2 soft canyon	yes-high	yes-high	yes-high	yes-50%
5	6.13	19%	Slope 1 Soft Canyon	yes- high	yes-med	yes-med	yes-100%
6	6.62	13%	Shelf Break soft	yes-high	yes-low	yes-med	no
7	3.52	9%	Slope 2 soft canyon	yes-med	yes-high	yes-med	no
8	5.32	33%	Slope 2 soft canyon	yes-med	yes-med	yes-high	no
9	2.34	5%	Slope 2 soft canyon	yes-high	yes-high	yes-low	no
10	3.23	1%	Rise soft canyon	yes-med	not sampled	yes-low	no
11	1.56	16%	Slope 2 soft	yes-med	yes-high	yes-low	no
12	4.17	32%	Shelf hard	yes-med	yes-high	yes-med	yes-50%
13	2.00	0%	Slope 2 soft	yes-low	not sampled	yes-low	no
14	2.41	0%	Slope 1 Soft	yes-med	yes-high	yes-med	yes-50%
15	5.31	18%	Shelf Break soft	yes-med	yes-med	yes-med	yes-25%
16	3.12	73%	Slope 2 hard	yes-high	yes-high	yes-low	no

Selected Publications

Ainley D, Spear L, Casey J, Ford RG, Gill T, et al. 2012. Chapter 3: Biogeography of Marine Birds. A Biogeographic Assessment off North/Central California. Retrieved from Center for Coastal Monitoring and Assessment (NCCOS), National Ocean Service. <http://ccma.nos.noaa.gov/ecosystems/sanctuaries/california/html/birds/>

Benson SR, Forney KA, Harvey JT, Carretta JV, Dutton PH. 2007. Abundance, Distribution, and Habitat of Leatherback Turtles (*Dermochelys coriacea*) Off California, 1990– 2003. *Fishery Bulletin*, 105(3): 337-347. Available at: http://aquaticcommons.org/8876/1/benson_Fish_Bull_2007.pdf
<http://montereybay.noaa.gov/research/techreports/trbenson2007.html>.

Brown JA, EJ Burton, S De Beukelaer. 2013. The Natural Resources of Monterey Bay National Marine Sanctuary: A Focus on Federal Waters. Marine Sanctuaries Conservation Series ONMS-13-05. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries, Silver Spring, MD. 264 pp. Available at: <http://montereybay.noaa.gov/research/techreports/trbrown2013.html>

Cailliet GM, Andrews AH, Wakefield WW, Moreno G, Rhodes, KL. 1999. Fish Faunal and Habitat Analyses Using Trawls, Camera Sleds and Submersibles in Benthic Deep-Sea Habitats Off Central California. *Oceanologica Acta*, 22(6): 579-592.

Embley RW, Eittreim SL, McHugh CH, Normark WR, et al. 1990. Geological Setting of Chemosynthetic Communities in the Monterey Fan Valley System. *Deep-Sea Research Part A-Oceanographic Research Papers*, 37(11): 1651 and DOI: 10.1016/0198-0149(90)90069-8.

Leeworthy VR, Jerome D, Schueler K. 2014. Economic Impact of the Commercial Fisheries on Local County Economies from Catch in All California National Marine Sanctuaries 2010, 2011 and 2012. Marine Sanctuaries Conservation Series ONMS-14-03. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries, Silver Spring, MD. 46pp. Available at: <http://montereybay.noaa.gov/research/techreports/trleeworthy2014.html>

McHugh CM, Ryan WB, Eittreim S, Reed D. 1998. The Influence of the San Gregorio Fault on the Morphology of Monterey Canyon. *Marine Geology*, 146(1-4): 63-91.

Monterey Bay Aquarium Research Institute (MBARI). 2015. *Video Annotation and Reference System (VARS)*. World Wide Web electronic publication. [<http://www.mbari.org/vars/>, version 7/27/15]. Accessed [08/01/15].

NOAA National Centers for Coastal Ocean Science (NCCOS). 2003. A Biogeographic Assessment off North/Central California: To Support the Joint Management Plan Review for Cordell Bank, Gulf of the Farallones, and Monterey Bay National Marine Sanctuaries: Phase I - Marine Fishes, Birds and Mammals. Prepared by NCCOS's Biogeography Team in cooperation with the National Marine Sanctuary Program. Silver Spring, MD. 145 pp.

Paull CK, Caress DW, Ussler III W, Lundsten E, Meiner-Johnson M. 2011. High-resolution bathymetry of the axial channels within Monterey and Soquel submarine canyons, offshore central California. *Geosphere*, 7(5): 1077.

Nearby Studies:

Collins CA, Garfield N, Rago TA, Rischmiller FW, Carter E. 2000. Mean Structure of the Inshore Countercurrent and California Undercurrent of Point Sur, California. *Deep Sea Research Part II: Topical Studies in Oceanography*, 47(5): 765-782.